

**Platelet-Rich Plasma:
A New Treatment for Tendon and Ligament Injuries in Horses**

Andris J. Kaneps, DVM, PhD, Diplomate ACVS

Bryan G. Parrott, DVM

Parrott Equine Associates, PO Box 298, Hamilton, MA 01936

Tendon and ligament injuries are a common cause of lameness in horses. Over 30% of racehorse lameness is due to tendon or ligament injury. Traditional treatment of these injuries often requires 6 to 12 months for rehabilitation. Healing may be incomplete, resulting in a weaker healed tendon. Also, traditional treatments have a 30-50% failure rate.

Because of these factors continued research for new treatment techniques for tendon and ligament injuries is an active area of equine research. In this vein, platelet-rich plasma (PRP) therapy for equine tendon and ligament injuries has been investigated at Parrott Equine Associates and The Ohio State University College of Veterinary Medicine.

What is Platelet-Rich Plasma?

PRP is the result of processing whole blood to obtain the blood fraction that has the highest concentration of platelets. Platelets contain a number of growth factors within their α -granules that are released upon activation.^{1,4} Large amounts of transforming growth factor beta (TGF- β) and platelet derived growth factor and smaller amounts of insulin-like growth (IGF), epidermal growth factor (EGF) and TGF- α are released upon activation from human blood.² These growth factors and others act synergistically to enhance access of healthy inflammatory cells to the area of tissue injury, formation of new blood vessels (angiogenesis), formation of new connective tissue (fibroplasia) and regeneration of skin (re-epithelialization).³ PRP has been used to enhance bone healing, bone-implant security and wound healing.⁵⁻⁸

Methods to concentrate platelets in humans have been adapted to the horse. Dr. Wes Sutter at The Ohio State University evaluated two commercial methods for production of platelet concentrates from equine blood by comparing platelet and growth factor concentrations.⁹ Equine whole blood was collected and processed either by a buffy coat method or apheresis method to produce platelet poor and platelet rich fractions. Packed cell volume, white blood cell count, and platelet count were compared between each method and among the platelet poor, whole blood, and platelet rich fractions. Growth factor concentrations of transforming growth factor beta (TGF- β 1 and TGF- β 2) and insulin-like growth factor (IGF-1) were compared between the two methods, and correlated to platelet counts. IGF-1 has higher concentrations in blood plasma, not in PRP, so was evaluated as a control for the PRP concentration techniques.

Platelet counts were concentrated 9.2-fold by the buffy coat method and 5.2-fold by the apheresis method compared to whole blood values. The apheresis platelet concentrate fraction platelet count was further concentrated by a commercial filtering procedure to 14-fold greater than whole blood. TGF- β 1 concentration in the platelet concentrate was 2.8-fold greater with the buffy coat method and 4.3-fold greater with the apheresis method compared to whole blood. TGF- β 2 concentration was 3.6-fold greater with the apheresis method compared to whole blood. IGF-1 was not concentrated using either method compared to whole blood, verifying that this growth factor is not concentrated in PRP. Platelet concentrations correlated with growth factor concentrations.

This study proved that platelets and TGF- β 1 can be concentrated reliably from equine blood using either method without modification of human protocols. Concentration of platelets from whole blood and platelet concentrate correlated with concentration of TGF- β 1 and, therefore, a comparison of platelet count in the platelet concentrate as compared to whole blood can estimate the concentration of TGF- β 1 in similar fractions. The apheresis method resulted in higher concentrations of TGF- β 2 and IGF-1 than did the buffy coat method, the biologic advantage of which was not determined from our study.⁹

Injection of PRP is recommended for both recent tendon and ligament injuries and those injuries that have not healed using traditional rest and controlled exercise. We recommend injection of a recent injury 30 days after occurrence. The procedure is done in the standing horse under sedation and local nerve block. Whole blood is obtained from the horse, blood is processed, and the PRP is injected into the tendon or ligament injury. The limb is bandaged for three days. The horse returns to a controlled exercise protocol based on the severity of injury and level of lameness. Re-examination with ultrasonography is conducted every 30 days over the first two months, then every 60 to 90 days during the remaining healing period. In most cases a single PRP injection is needed to result in complete healing of the injury.

PRP has been injected in over 35 horses with tendon and ligament injuries at Parrott Equine Associates and The Ohio State University. Treatment has resulted in rapid healing of previously static lesions and return to soundness and function. Evaluation of clinical cases is ongoing, but our initial results indicate that PRP treatment of equine tendon and ligament injury is a tremendous improvement over other current techniques.

References

1. Moulin V. Growth factors in skin wound healing. *Eur J Cell Biol* 1995;68:1-7.
2. Zechner W, Tangl S, Tepper G, et al. Influence of Platelet-rich Plasma on Osseous Healing of Dental Implants: A Histologic and Histomorphometric Study in Minipigs. *The International Journal of Oral & Maxillofacial Implants* 2003;18:15-22.
3. Werner S, Grose R. Regulation of wound healing by growth factors and cytokines. *Physiol Rev* 2003;83:835-70.
4. Rendu F, Brohard-Bohn B. The platelet release reaction: granules' constituents, secretion and functions. *Platelets* 2001;12:261-73.
5. Marx RE, Carlson ER, Eichstaedt RM, et al. Platelet-rich plasma: Growth factor

- enhancement for bone grafts. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;85:638-46.
6. Kim S, Chung C, Kim Y, et al. Use of particulate dentin-plaster of Paris combination with/without platelet-rich plasma in the treatment of bone defects around implants. *International Journal of Oral and Maxillofacial Implants*. 2002;17:86-94.
 7. Hom DB, Thatcher G, Tibesar R. Growth Factor Therapy to Improve Soft Tissue Healing. *Facial Plastic Surgery* 2002;18:42-52.
 8. Carter CA, Jolly DG, Worden CE, et al. Platelet-rich plasma gel promotes differentiation and regeneration during equine wound healing. *Experimental and Molecular Pathology* 2003;74:244-255.
 9. Sutter WW, Kaneps AJ, Bertone AL. Comparison of a buffy coat method and an apheresis method for procurement of platelet concentrates and growth factors in horses. *Am J Vet Res* 2004: accepted for publication